April 12, 1927. 1,624,869

H. INGRAM

VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

Filed June 24, 1922 10 Sheets-Sheet 1

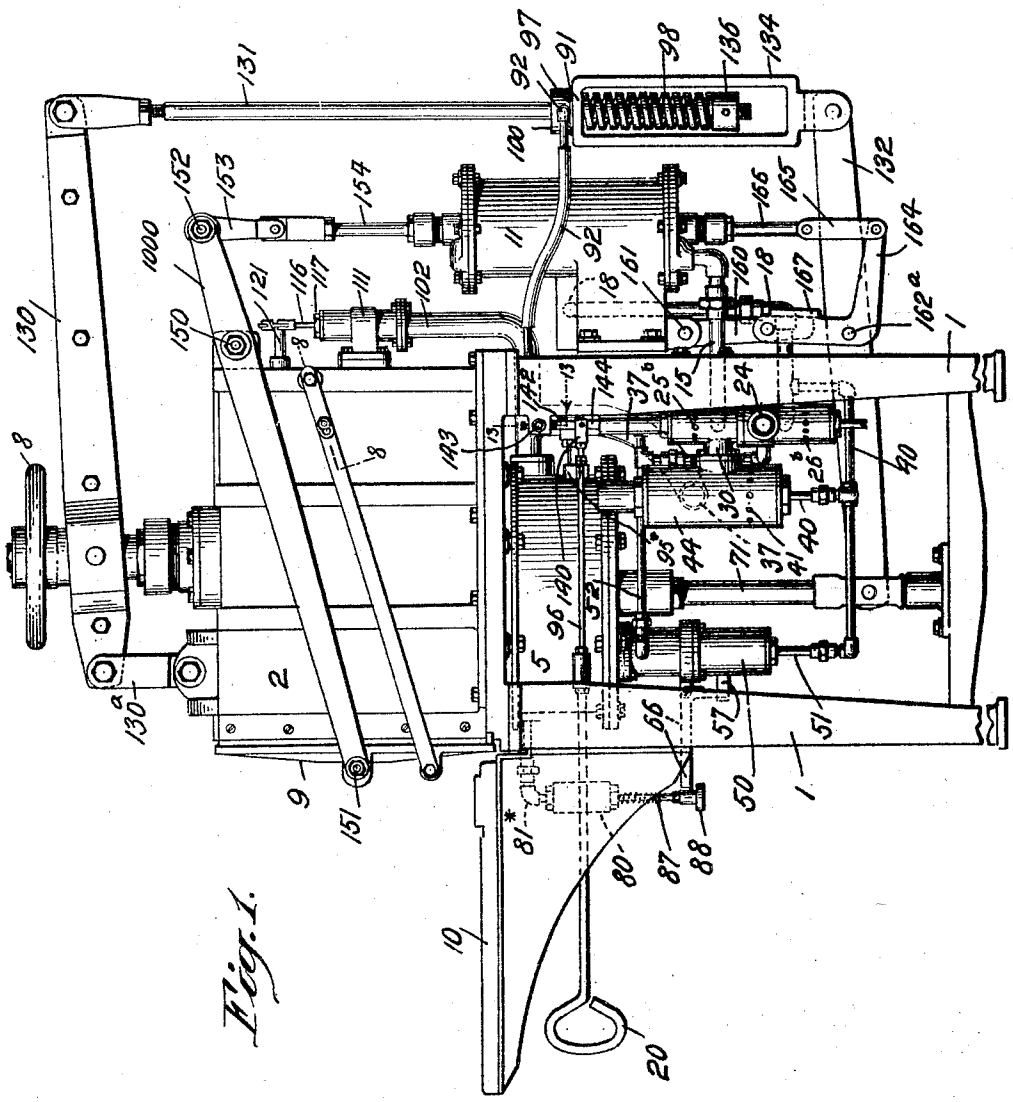

Fig. 1.

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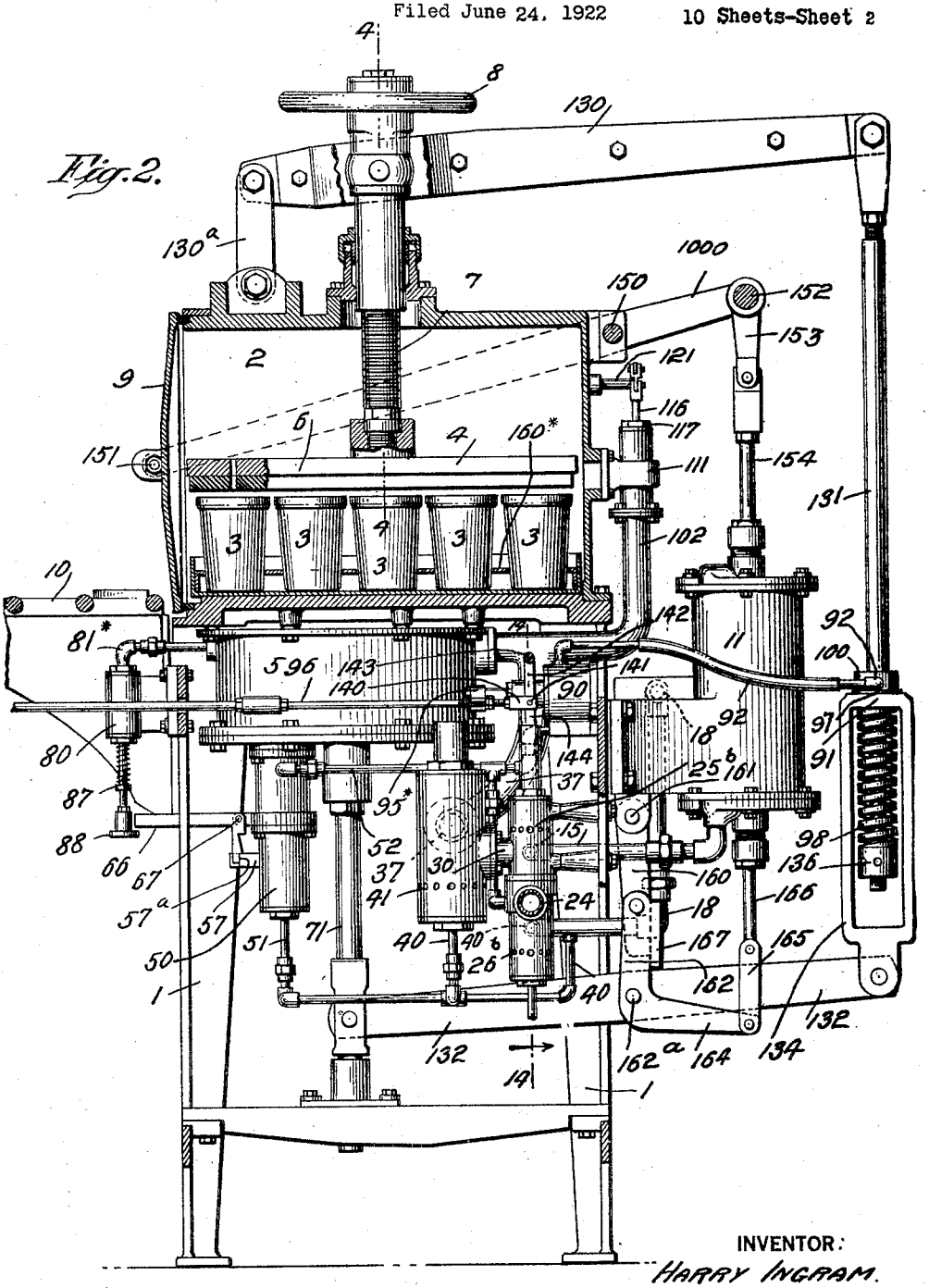
Fig. 2.



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VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

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Fig. 3.

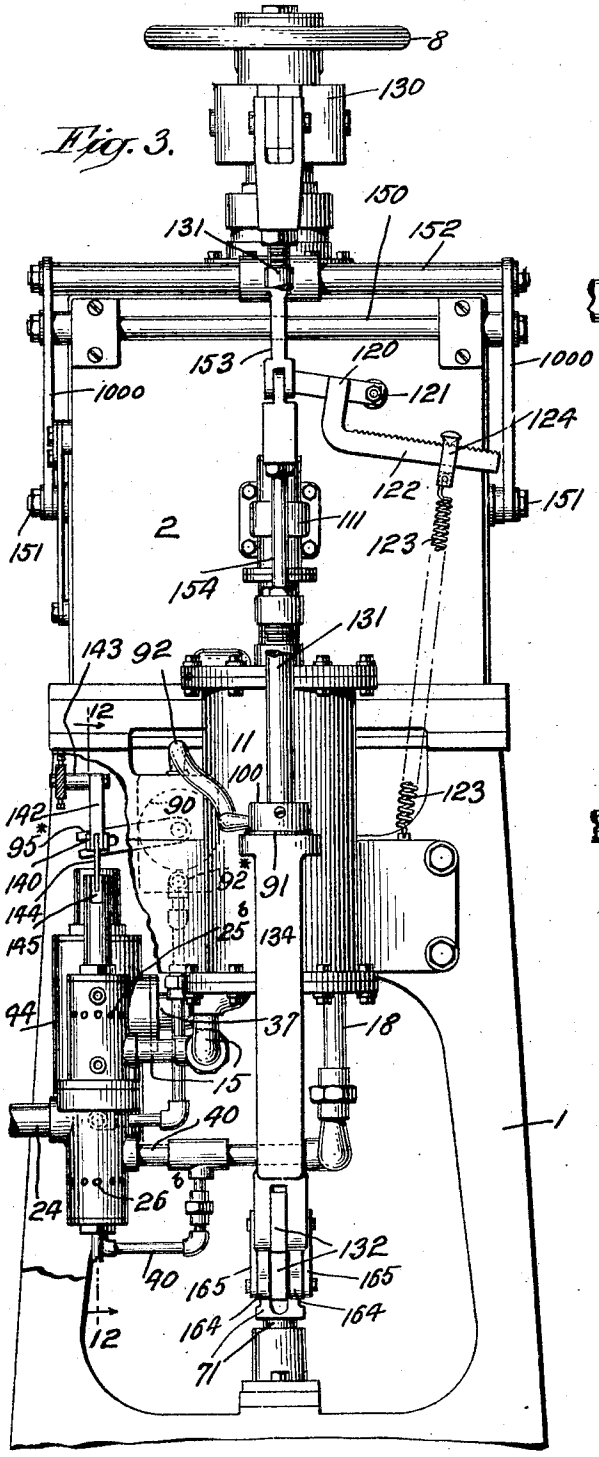
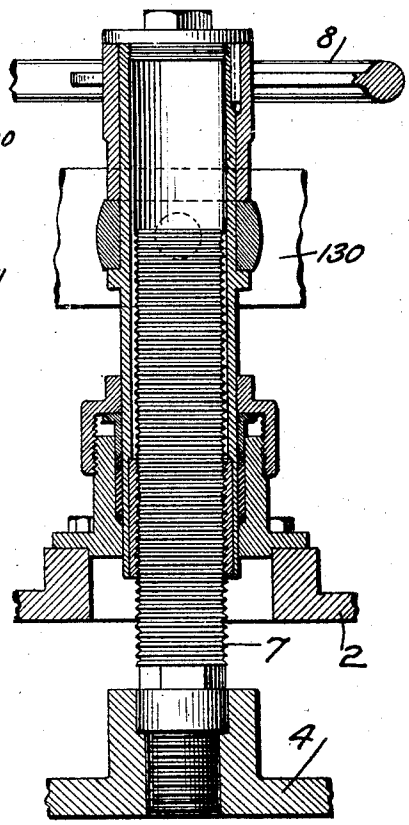


Fig. 4.



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VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

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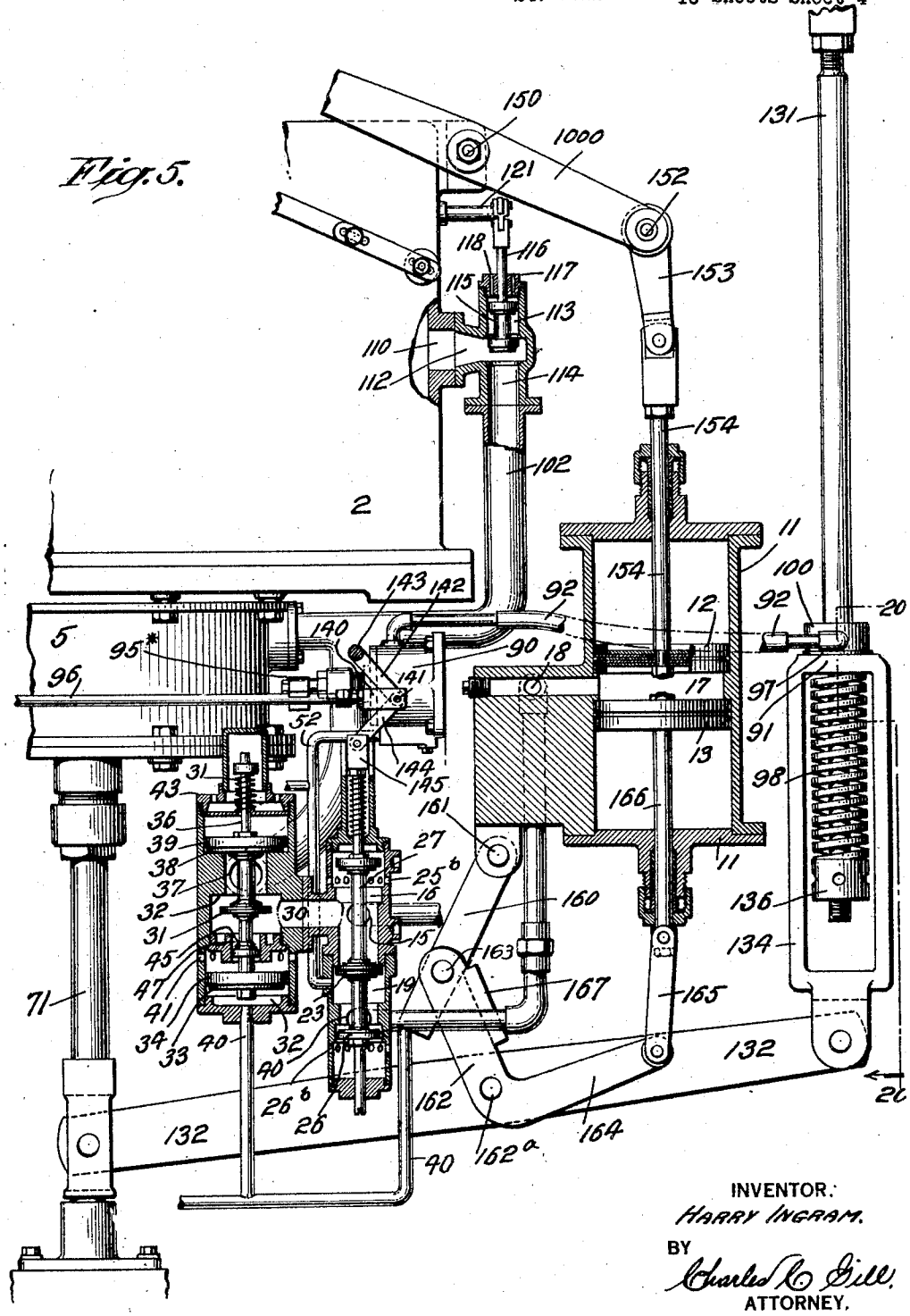
Fig. 5.



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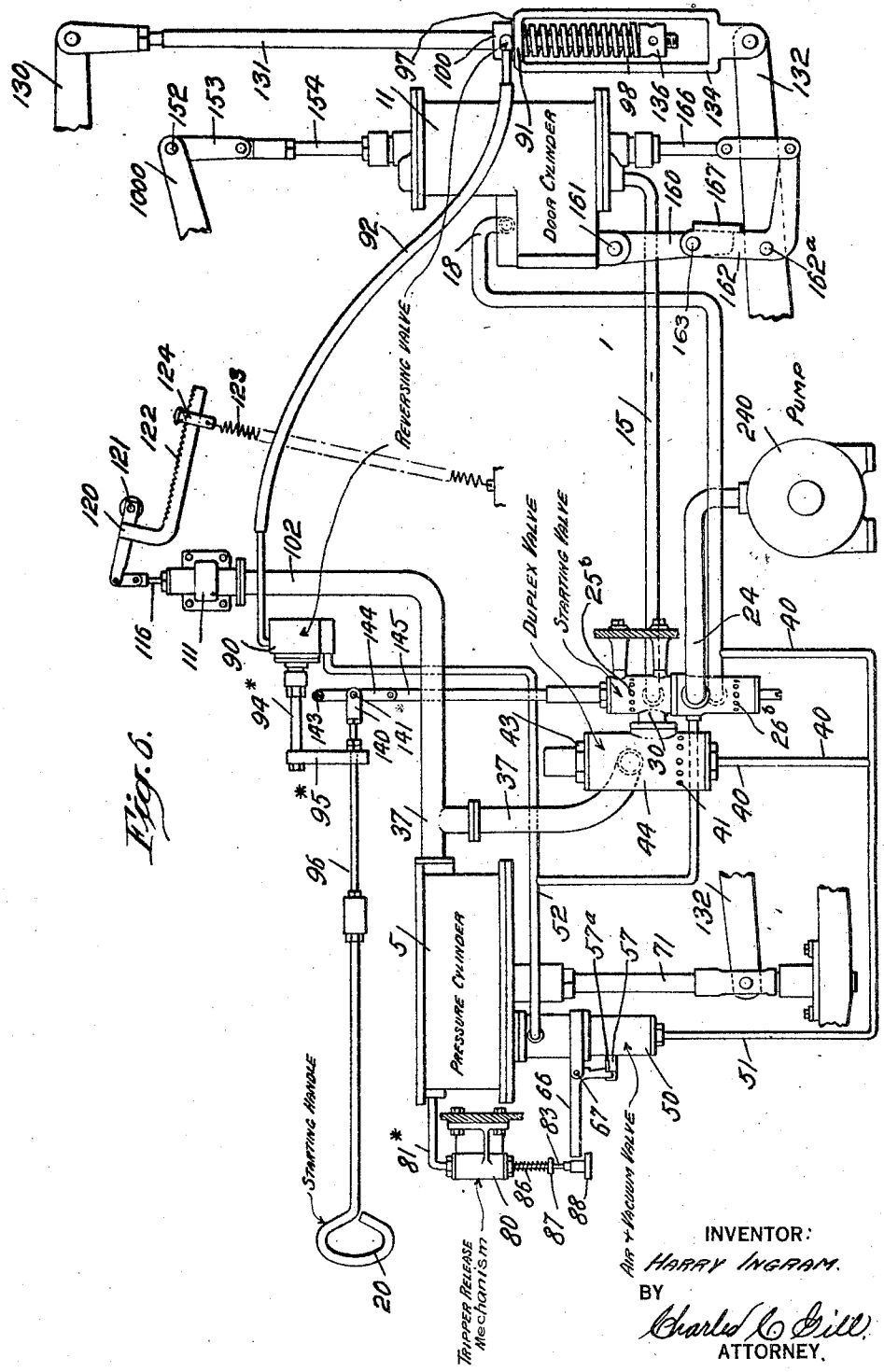

Fig. 6.

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VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

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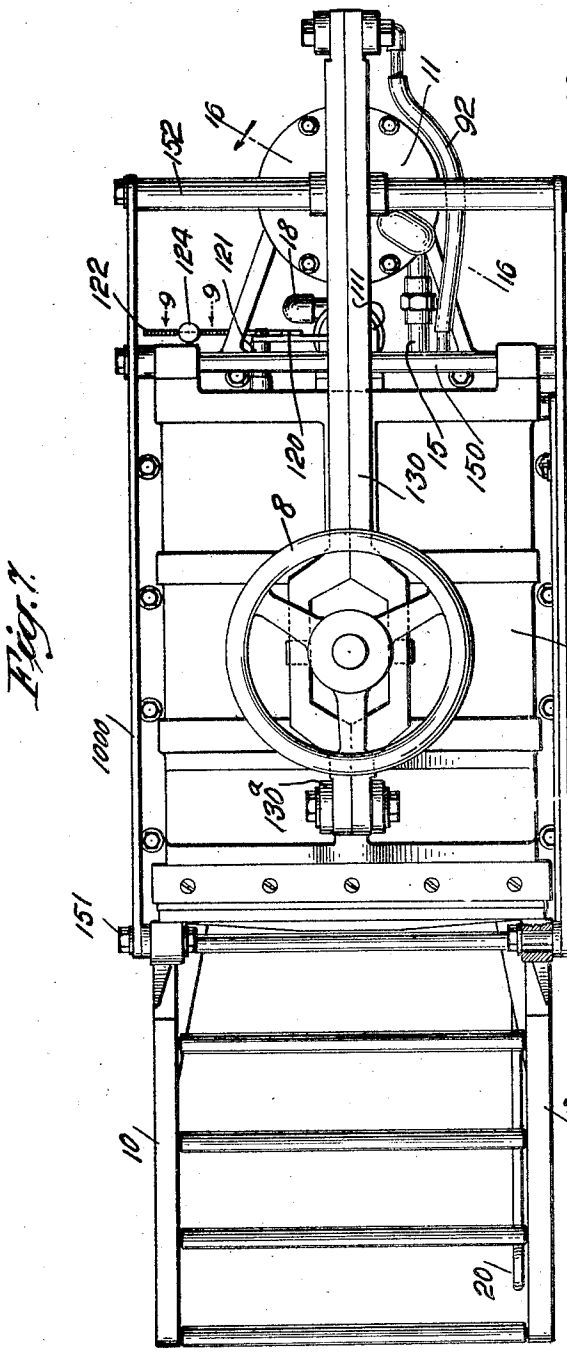

Fig. 1.

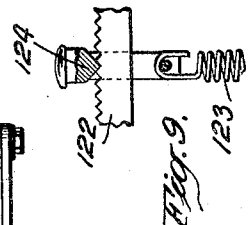

Fig. 9.

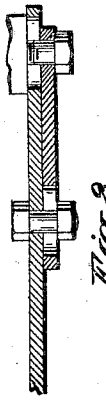

Fig. 8.

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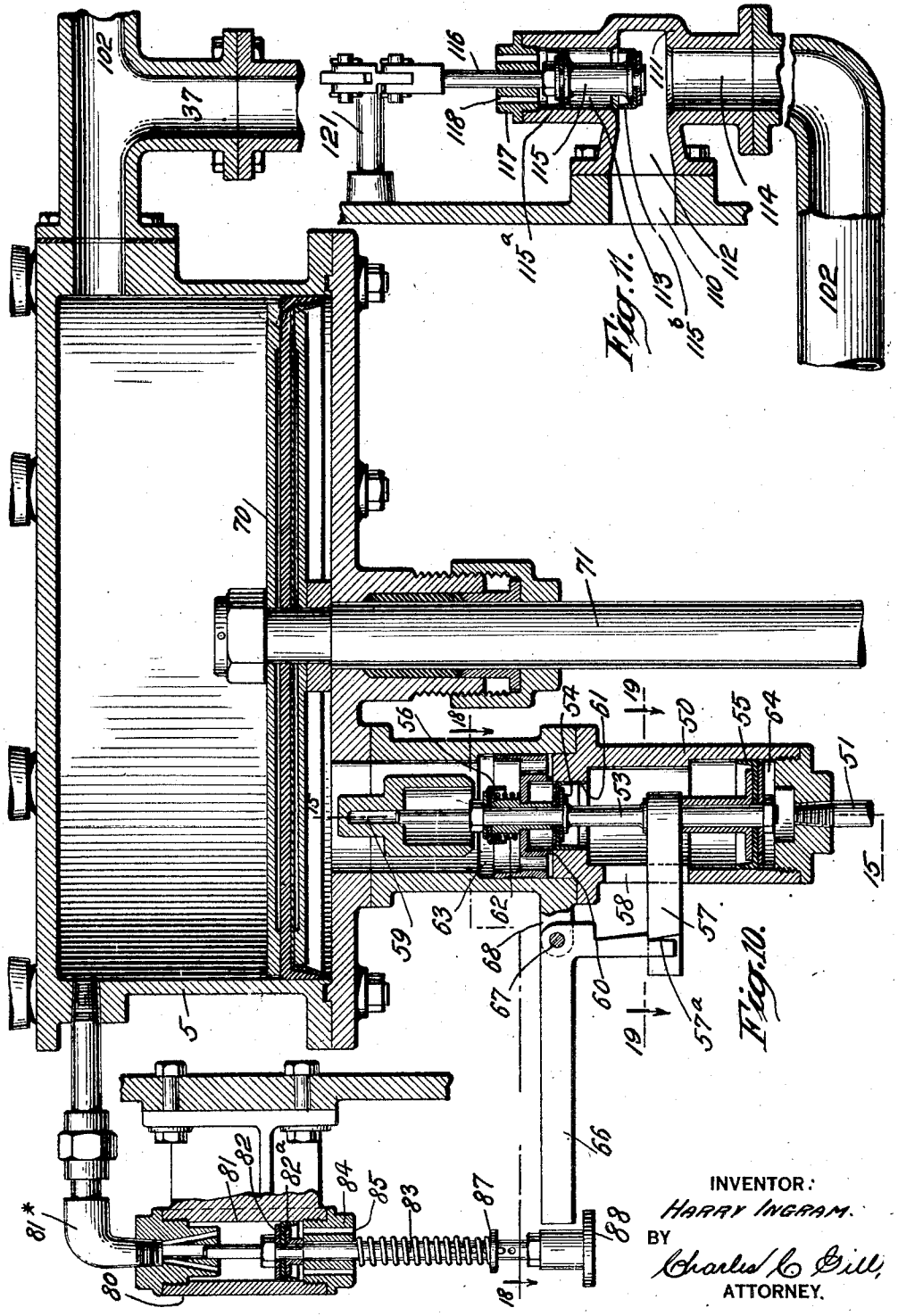

Fig. 11.

Fig. 10.

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VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

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Fig. 12.

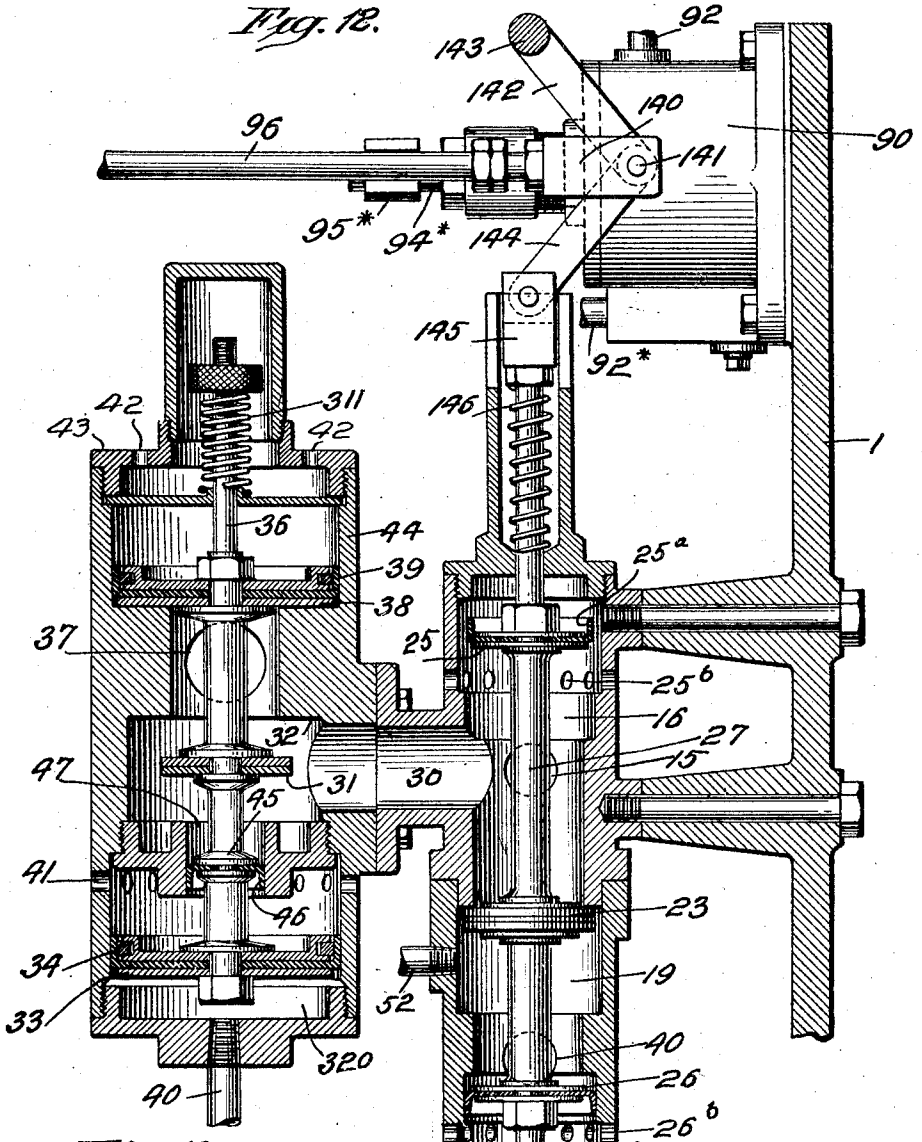
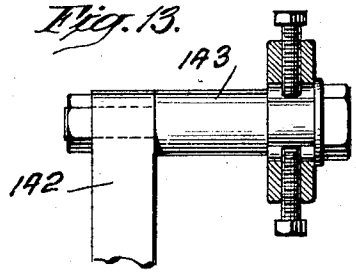


Fig. 13.



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VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

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Fig. 15.

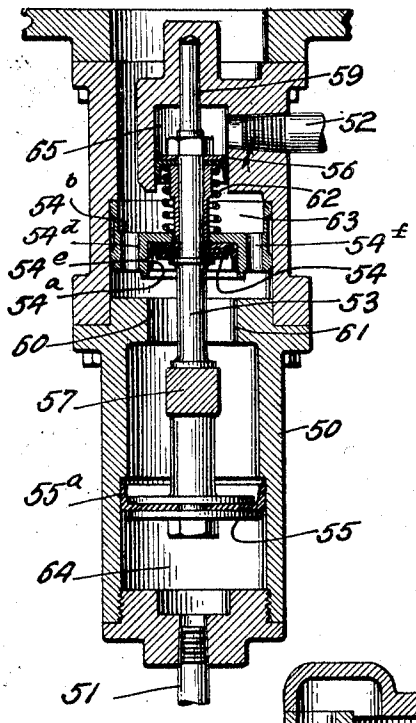
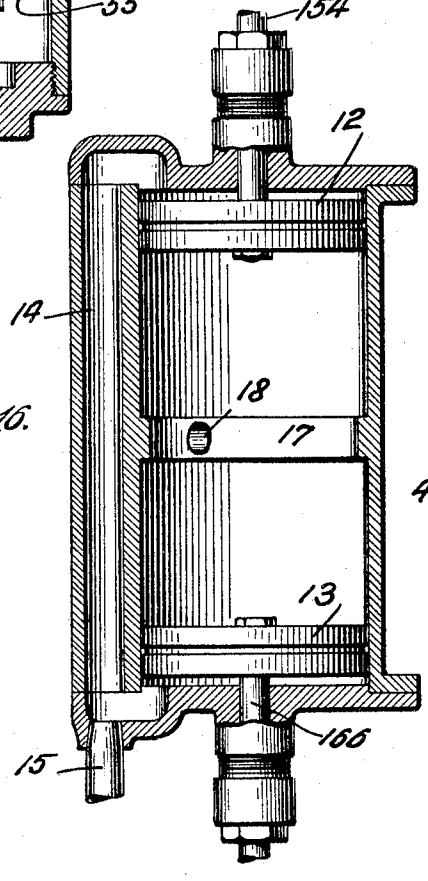


Fig. 16.



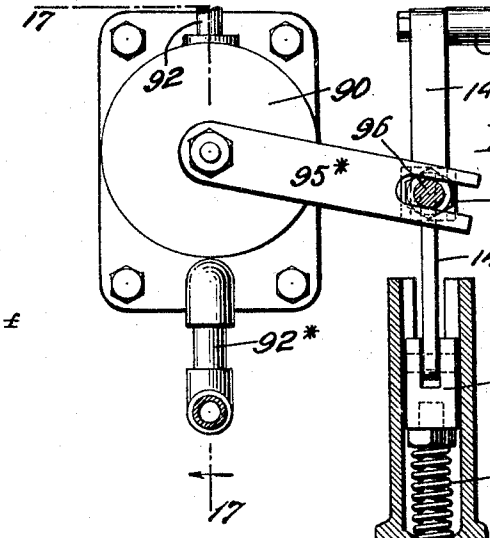


Fig. 14.

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VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS

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Fig. 17.

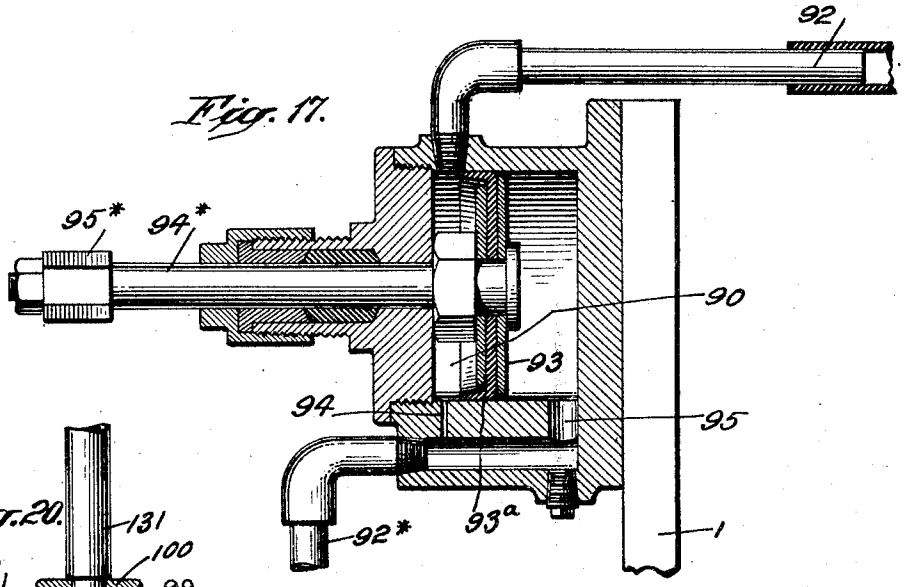


Fig. 20.

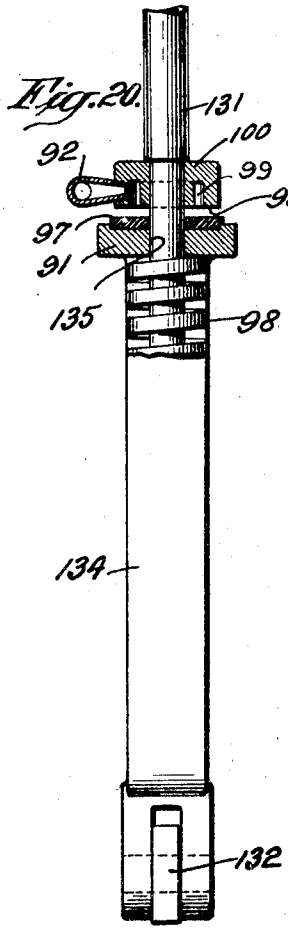


Fig. 18.

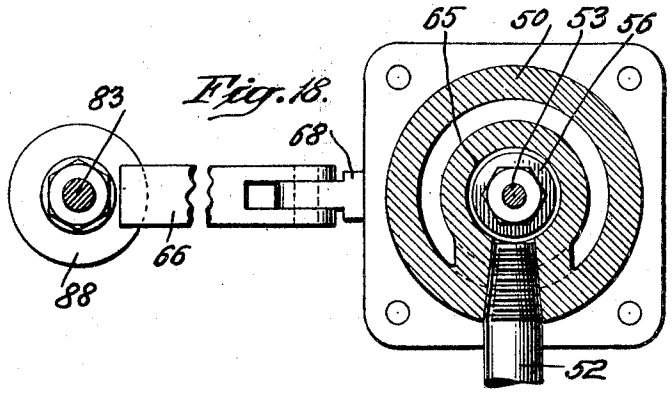
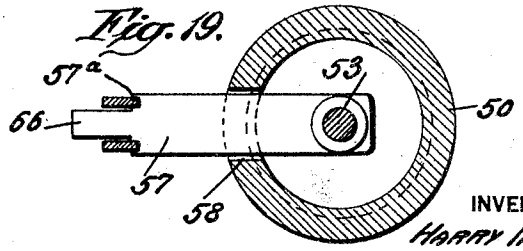


Fig. 19.



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UNITED STATES PATENT OFFICE.

HARRY INGRAM, OF BROOKLYN, NEW YORK.

VACUUM SEALING MACHINE FOR JARS AND OTHER CONTAINERS.

Application filed June 24, 1922. Serial No. 570,687.

This invention relates to machines for applying caps to containers such as tumblers and jars, more particularly under vacuum.

My invention has for its purpose, in its more complete and preferred embodiment, the production of a sealing machine operated by a vacuum pump or like device as the sole actuating agency.

According to this invention the pump not only produces a predetermined amount of vacuum within the containers or packages during capping but also supplies the power to do the capping and effect a complete cycle of the operations of the machine.

The machine of my invention comprises a sealing box or closet within which the goods are vacuumized and sealed and which box or closet has a door to be opened and closed and contains a pressing head or plate which at first is lowered sufficiently near to the caps primarily loosely placed on the jars to prevent the caps from becoming displaced entirely from the jars when a vacuum is created in said box or closet and thereafter is depressed against said caps to seat them in final position on the jars, and in addition to these features the machine of my invention comprises certain novel valves and connections whereby its several mechanical parts through the action of a pump or other suitable means of obtaining a vacuum are operated to effect successive results by a preponderance of atmospheric pressure at certain points in the mechanism and an automatic shifting of such preponderance of pressure to other points of the mechanism, the action of the vacuum pump while continuing to run in the same direction, resulting in the closing of said door of the sealing box or closet, the lowering of the pressing head or plate to a position adjacent to the loosely placed caps on the jars, the creation of a predetermined amount of vacuum in said box or closet and said jars, the further lowering of said head or plate to push the caps to final position on the jars, the opening of the door of the box or closet, the elevation of said head or plate from the caps for releasing the jars for removal and the return of the several parts of the machine into proper position for the next operation of the machine. The cycle of operations just recited are performed automatically, the vacuum being maintained in certain portions of the machine for maintaining the machine in normal position ready for operation, the direction of the flow of air being then diverted for establishing the vacuum at other points of the mechanism for the vacuumizing of the packages and the final positioning of the caps thereon, and a further change in the direction of the air through the machine being then effected to change the portions under vacuum, whereby to open the door of the sealing box or closet, elevate the pressing head or plate from the caps and return the machine to normal condition preparatory to the next operation. To provide a successful machine possessing the characteristics and automatic operation described, is of course one of the prime objects of my invention, and I believe the machine of my invention to be generically new.

An important feature of the invention is the provision of means for automatically cutting off the action of the pump from the sealing box or closet without stopping the pump when the proper degree of vacuum for the goods being handled has been established in said box or closet, so that the pump may continue in action for applying power to the operative mechanism of the machine without disturbing or increasing the degree of vacuum being maintained in said box or closet. The degree of vacuum required in the sealing box or closet varies greatly in accordance with the nature of the goods being handled, and when the proper degree of vacuum in said box has been obtained, the box is automatically shut off from the action of the pump because a greater degree of vacuum power might be required from the pump for continuing the operation of the machine, as, for illustration, pressing the caps home on the jars and opening the door of the box.

In order that the invention may be fully understood there will now be described by way of example and with reference to the accompanying drawings, a machine embodying the said invention. In these drawings

Fig. 1 is a side elevation of the machine,

Fig. 2 is a similar elevation, partly in section,

Fig. 3 is a rear elevation,

Fig. 4 is a detail view on a larger scale than Figs. 1—3, being a section at 4—4 in Fig. 2,

Fig. 5 is a partial section, also on a larger

scale, showing several of the valves and the door cylinder,

Fig. 6 is a general diagrammatic representation of the machine, showing the pipe connections,

Fig. 7 is a top plan view,

Fig. 8 is a detail view, on a large scale, being a section at 8—8 of Fig. 1,

Fig. 9 is a detail view taken at 9—9 of Fig. 7,

Fig. 10 is a sectional view, on a large scale, showing the pressure cylinder and adjacent parts,

Fig. 11 is a sectional view showing the vacuum regulator valve,

Fig. 12 is a large scale sectional view taken at 12—12 of Fig. 3,

Fig. 13 is a large scale detail view, taken at 13—13, Fig. 1,

Fig. 14 is a view of the starting valve in section at 14—14, Fig. 2,

Fig. 15 is a section taken at 15—15, Fig. 10,

Fig. 16 is a section taken at 16—16, Fig. 7,

Fig. 17 is a section taken at 17—17, Fig. 14,

Fig. 18 is a section taken at 18—18, Fig. 10,

Fig. 19 is a section taken at 19—19, Fig. 10, and

Fig. 20 is a section taken at 20—20, Fig. 5.

The machine according to this invention, in the preferred construction shown, comprises a frame 1 on which is mounted the sealing box 2 connected with the vacuum pump 240 and adapted to receive a number of containers to be capped. Inside the sealing box is arranged the sealing head 4 actuated by a pressure cylinder 5 bolted to the bottom of the box. The sealing head 4 forces the caps 6 on the glasses and is held by the cylinder above said glasses at the proper time. Adjustment of the sealing head to accommodate containers of different heights is effected by a screw and handwheel mechanism 7, 8, the handwheel 8 being above the sealing box.

The front of the box is open and is equipped with a vertically sliding door 9 operated automatically by means of rocking levers and a power cylinder 11 at the rear of the machine. The door operating cylinder 11 also controls a preliminary movement of the sealing head 4 for the purpose of bringing the same into close proximity to the loosely applied caps, so that the air in the containers will not lift the caps off same when the vacuum is generated in the sealing box prior to forcing on the caps. In front of the sealing box there is a table 10, substantially on the level of the floor of the said box. The door operating cylinder 11 has two pistons 12, 13 operating respectively the door and the sealing head, and this cylinder is connected by passages 14, 15 at both end portions as shown in Fig. 16 to the upper chamber 16 of the starting valve hereinafter described while the central space 17 in the cylinder between the two pistons communicates by a conduit 18 with the lower chamber 19 of the starting valve.

All the operations of the machine are effected by power derived from the vacuum pump, under the control of a series of valves, already mentioned.

One of these valves, termed the starting valve, is controlled by a starting handle 20 conveniently located at the front of the machine and suitable connections. Said valve has an upper and a lower chamber 16, 19 each with a valve seat 21, 22 co-operating with the valve body 23; both chambers are connected to the pump by the pipe 24 and the arrangement is such that when the valve body 23 is on the upper seat the upper chamber 16 is open to atmosphere and the lower chamber 19 in communication with the pump, while when the valve body 23 is on the lower seat 22 the upper chamber 16 is in communication with the pump and the lower chamber 19 open to atmosphere. This disposition is effected by means of heads 25, 26 mounted on the stem 27 of the valve body 23, as shown in Fig. 14. The upper head carries a cup washer 25^a which co-operates with a series of holes 25^b in the wall of the upper chamber to connect and disconnect the chamber 16 with and from atmosphere, and the lower head 26 is similarly equipped with a washer 26^a controlling holes 26^b. Normally, when the machine is standing idle and the pump running, the valve body is on the upper seat, and pulling forward the starting handle shifts the valve body on to the lower seat. All parts of the machine receive vacuum through the starting valve.

Another of these valves is the duplex valve, (Fig. 12) which is connected by a passage 30 to the upper chamber 16 of the starting valve. The duplex valve comprises a chambered casing as show in Fig. 12, enclosing a stem 36 on which are mounted a number of heads or valve members. The centrally located head 31 is a flat leather washer co-operating with a seat 32 and controlling communication between the duct 30 and the pipe 37 leading to the pressure cylinder. At the lower end of the stem is a valve head 33 fitted with a cup washer 34, the under side of which head communicates with the lower chamber of the starting valve through a pipe 40 and the upper side of which is always exposed to atmospheric pressure through the holes 41.

Near the upper end of the stem 36 is a similar valve head 38 and cup washer 39, the space above said head communicating with the atmosphere through holes 42 in the cap 43 of the valve casing 44. A further head 45 with cup washer 46 working in a

restricted cylindrical bore 47, prevents atmospheric pressure from reaching the central chamber of the valve casing 44 by way of the holes 41. The duplex valve body 31 is normally held on its seat 32 and is adapted to open automatically when sufficient vacuum is created in the said chamber. The duplex valve controls the evacuation of air from the top of the pressure cylinder and the sealing box and also the re-admission of air thereto after capping. The duplex valve is spring loaded, the spring 311 tending to hold the valve washer 31 closed on its seat and being adjustable.

Another of said valves, termed the air and vacuum valve, is bolted to the bottom of the pressure cylinder, and its function is to admit air into the bottom of said cylinder and to connect same to vacuum, at the proper times. The casing 50 of this valve has two pipe connections 51, 52, one 51 extending from the lower part of the starting valve to the lower part of the air and vacuum valve for giving vacuum to this lower part and holding down the valve while the machine is idle and the door open; the other pipe connection 52 extending from the centre of the starting valve to the top of the air and vacuum valve, and giving vacuum thereto regardless of the position of the starting valve. 53 is a stem carrying valve heads 54, 55 and 56 and an arm 57 extending laterally through a slot 58 in the wall of the casing. The upper end of the stem is guided by a socket 59 in the casing. The head 54 co-operates with an opening 60 in a transverse wall 61 in the casing, a spring 62 being arranged as shown in Fig. 15 between the head 56 and the head 54. When the valve-head 54 is seated it shuts off communication between atmosphere and the upper part 63 of the casing. The lowest head 55 has a cup washer 55^a and slides in a cylindrical bore 64 of the casing, and the upper head 56, also fitted with a cup washer, slides in a small cylindrical bore 65 to which is connected the pipe 52, all as shown best in Fig. 15. The arm 57 has a tooth 57^a engaging a tripper catch 66 pivoted at 67 on a lug 68 projecting from the casing 50, as shown in Fig. 10. The valve head 54 has a cup washer 54^a which is enabled to cooperate with the opening 60 without damage by means of a guide sleeve 54^b slidable in the part 63 of the casing. The guide sleeve has a boss 54^d having a bore 54^e of the same diameter as the opening 60. This boss 54^d comes to rest on the edge of the opening just before the washer 54^a reaches said opening, and the bore 54^e then forms a continuous surface with the walls of the opening, enabling the washer to pass safely from the bore 54^e into the opening. The sleeve 54^b forms an abutment for the lower end of the spring 62 and has holes 54^f therein for admitting atmospheric pressure to the space 63. The valve stem 53 of the air and vacuum valve is held down normally by the catch 66 which is controlled by the tripper release mechanism hereinafter described. On release of this catch the valve stem 53 flies upward and air passes the valve head 54 and enters the lower part of the pressure cylinder 5, raising the piston 70 thereof and through lever mechanism described later causes the sealing head to come down on the packages in the box to complete the actual sealing operation. Backward movement of the starting handle produces reverse operations and prepares the cylinder for the next operation.

The tripper release mechanism (Fig. 10) already mentioned regulates the time at which the air and vacuum valve is released, and its casing 80 is connected by a pipe 81* to the top of the pressure cylinder 5. The casing 80 has a cylindrical bore 81 in which works a piston 82 fitted with cup washer 82^a and carried on a stem 83. The casing has a bottom cap 84 with holes 85 therein admitting atmospheric pressure to the under side of the piston 82, and this cap serves as one abutment for the controlling spring 86 the other abutment of which is a collar 87 adjustable on the stem 83. The lower end of the stem carries another collar 88 adapted to operate the catch 66. When there is sufficient vacuum above the head 82 to raise the head against the spring action, the collar 88 on the valve stem releases the catch 66 of the air and vacuum valve as aforesaid.

Another of the valves is the reversing valve (Figs. 17 and 20) provided to reverse the starting valve automatically after the machine has completed the capping operation thus causing the door to open and making the machine ready for the next operation. The reversing valve consists of two separate parts 90, 91 connected by a flexible tube 92, viz. a cylinder 90 and a spring closed air valve 91. The reversing valve cylinder 90 is in communication with the pump through a pipe 92* and when the latter is running there is vacuum on both sides of the plunger 93 in said cylinder, the openings 94, 95 to vacuum being small on the front side of the plunger and larger on the rear side. The flexible pipe connection 92 referred to is on the front side of the plunger. The plunger 93, fitted with cup washer 93^a, is carried by a rod 94* which bears at its free end a slotted member 95* which engages the rod 96 of the starting handle, as shown in Fig. 6. The spring closed air valve 91 is located in the driving connections between the piston 70 of the power cylinder and the sealing head 4, as shown in Fig. 2. The valve washer 97 (Fig. 20) is normally held on the valve seat 98* by the pressure of the large spring 98, and

when moved off said seat, atmospheric air enters the annular chamber 99 in the valve body 100 and thence proceeds through the flexible tube 92 to the cylinder 90. When the sealing head comes down onto the containers it stops when the caps are driven home on the latter, but the piston in the pressure cylinder continues to move compressing the spring on the air valve, which moves said valve from its seat and allows air to rush to the front end of the reversing cylinder, and as the air comes in through a larger opening than that through which it is being drawn out by the pump it causes the piston to be forced back, which pulls the slotted piece 95 against a collar on the starting valve rod causing this valve to snap back to starting position.

The amount of vacuum in the sealing box is regulated by a vacuum regulator valve (Fig. 11), which is connected to the box by a duct 110 and by means of a pipe 102 to the pipe 37 (Fig. 6), whereby the regulator valve communicates with the duplex valve and the pressure cylinder, as shown. The valve casing 111 has a central chamber 112 and upper and lower cylindrical bores 113, 114. The valve member 115 has two cup-washers 115^a, 115^b, and is carried on a stem 116 extending through a cap 117 which has holes 118 therein admitting atmospheric pressure to the upper end of the head. The uppermost washer 115^a controls the air admission orifices 118 and the lower washer 115^b controls communication between the valve casing and the sealing box. Means are provided for adjusting the spring action on the valve whereby any desired amount of vacuum may be obtained in the sealing box, which means comprise a bell-crank 120 pivoted at 121 and jointed at one end to the valve stem 116. The limb 122 of the bell-crank is notched (see Fig. 6) and is urged downwards by a spring 123, the force of which operating on the valve can be adjusted by varying the upper point of support on the limb 122 by means of the notches and the attachment device 124 engaging any of same. The sealing head 4 is rigidly connected to the screwed rod 7 engaging an internally threaded sleeve in the handwheel 8. All these parts are jointedly connected to a lever 130 pivoted at one end to a link 130^a jointed to the top of the box. At its other end the lever 130 is jointed to a link 131 connecting the lever 130 to another lever 132 (Fig. 5), connected to the piston-rod 71 actuated by the pressure cylinder. There is an extensible spring connection in the link 131, formed by a slotted member 134 jointed at its lower end to the lever 132 and having a bearing 135 at its upper end for the end of the link 131. The spring 98 previously referred to is located between the end of the slotted member 134 and the end of the link 131, where it abuts on an adjustable collar 136 (Fig. 2). It will thus be seen that when the piston 70 is forced upwards by atmospheric pressure, the movement is transmitted through said levers and links, to force down the sealing head 4, and that movement of the piston 70 can continue after the head 4 has been arrested by contact with the jars 3, owing to yielding of the spring 98. The starting handle 20 is at one end of a rod 96 the other end of which carries a member 140 jointed to a toggle device at 141 (Fig. 12). The upper link 142 of the toggle is pivoted to a fixed fulcrum 143, and the lower link 144 of the toggle is jointed to a head 145 on the end of the stem 27 of the starting valve. A spring 146 engages said head 145 and tends to maintain the toggle 142, 144 in bent position, as shown in Fig. 12. On pulling the rod 96 to the left in said figure, the toggle is straightened and the head 145 forced downwards, carrying with it the stem 27 and its valve heads. The connections of the upper piston 12 of the door cylinder to the door 9 are best shown in Figs. 2 and 5, and comprise the rocking levers 1000 pivoted intermediately on a fixed fulcrum 150, one end of said levers being jointed at 151 to the upright sides of the door, and their other ends to a cross-shaft 152 which is connected by a link 153 to the upper piston rod 154. The connections between the lower piston 13 of the door cylinder and the sealing head for effecting the preliminary movement thereof comprise a toggle device (Fig. 5) having one arm 160 pivoted at 161 to a lug on the door cylinder, and the other arm 162 pivoted at 162^a to the lever 132. The two toggle arms are jointed to each other by a pin 163. The toggle arm 162 has a tail 164 connected by a link 165 to the lower end of the piston rod 166 of the piston 13, as shown. The arm 162 also has an abutment 167, which, when the toggle is straight, bears against the upper edge of the lever 132 as shown in Fig. 2.

The operation of the machine will now be described.

The height of the sealing head 4 is adjusted by means of the handwheel 8 to suit the height of containers 3 to be capped. A number of containers arranged on a tray 160^* are sealed simultaneously. The desired degree of air exhaustion or air pressure in the sealing box 2 is set by trial and observation of a vacuum gauge on the box, and by adjusting the spring 123 of the vacuum regulator valve. The spring 86 of the tripper release mechanism is then set to cause said mechanism to operate immediately the vacuum gauge indicates the desired pressure.

Before starting operations without pump running, the door of the machine is closed from its own weight, and the plate and levers connected to the plate have dropped

with their own weight. The effect of the weight tends to straighten out the toggle 160, 162 which operates the preliminary movement of the sealing plate. In this position the machine is inoperative.

Upon starting the pump the vacuum is created between the pistons in the door cylinder, thus causing the pistons 12—13 to be together and opening the door and raising the plate at its highest position. The starting handle at this point is back. The top piston 12 holds the door 9 open and the bottom piston 13 holds the sealing head 4 up in the preliminary movement. Due to the air exhaustion through the connection 40 to the bottom part 320 of the duplex valve casing the valve member 31 thereof is held off its upper seat 32, allowing air from the upper chamber 16 of the starting valve to go through pipe 37 to the sealing box and to the upper part of the pressure cylinder; the stem 36 being thus held down, the lower part of the pressure cylinder receives a reduction of pressure due to exhaustion through the connection at the top of the air and vacuum valve, thus holding the sealing head 4 up.

Through the connection 92* on the lower side of the reversing valve cylinder, both sides of the plunger 93 in that cylinder receive an equal air pressure, allowing the starting handle to be moved.

The piston 70 came to its lowest position as the concluding part of the final previous operation of the machine. There is also a vacuum on both sides of the reversing valve at that time, and also in the lower chamber in duplex valve, as well as in the lower chamber of the air and vacuum valve.

The only effect of the pump at this time is to hold the door open and the plate up and to hold down the stem in the duplex valve.

Pulling the starting handle 20 as far out as it will go, brings the starting valve head 23 down on to its lower seat 22, thus closing the lower chamber of that valve from the pump and opening the upper chamber 19 to the pump.

As soon as the starting valve shuts off the lower chamber 19 from the pump, the vacuum in the lower part 320 of the duplex valve is destroyed by air coming through the starting valve; then the spring 311 on the duplex valve lifts the valve member 38 thereof off its seat and the washer 31 closes the opening to the sealing box and to the top of the pressure cylinder. Air is admitted into the center of the door cylinder through the lower chamber 19 of the starting valve and passage 18 and both ends of the door cylinder being connected to the upper chamber 16 of the starting valve, receive a reduction of pressure due to exhaustion; this causes the upper piston 12 to rise, closing the door, and the lower piston in the door cylinder 13 to move downward, causing the preliminary movement of the sealing head above referred to.

With the closing of the door 9 and the positioning of the plate, the flat leather washer in the duplex valve which has been lifted by the spring 311 is opened by atmospheric pressure from the top, thus opening the piping 37 connected to the upper part of the large pressure cylinder and also to the sealing box. The action of the atmosphere on the upper head 38 in the duplex valve maintains the valve 31 in an open position, leaving an open line from the box and the pressure cylinder through the duplex valve and the starting valve to the pump. This position is maintained until the sealing point is reached. Assuming that 20 inches of air pressure are desired in the packages, the pump operates until the point of 20 inches is reached. At this point the vacuum regulator valve situated on the back of the box becomes operative through atmospheric pressure exerted on the upper washer in that valve, causing the lower washer to be forced into the pipe opening in the main pipe leading from the box, thus shutting off any further suction on the box, but allowing the pump to still operate on the other portions of the machine.

Assuming that I wish to work with 25 inches of pressure in our operating cylinder, the pump continues pulling to that point. At this point we have 20 inches of air pressure in the box, and we have 25 inches of pressure in the other portions of the machine, namely, the top and bottom of the door cylinder, the top and bottom of the large pressure cylinder and all of the valves connected thereto, including the reversing valve which has more or less vacuum at all times and in all positions of the machine when the pump is running. At this point the tripper release casing 80 which is connected only to the upper part of the large pressure cylinder by pipe 81* has the same amount of vacuum which had been reached in the upper part of the pressure cylinder which is at this point 25 inches. The spring 83 on the lower part of the stem of this mechanism having been previously set to compress with 25 inches of atmospheric pressure, starts to move upward and the flange 88 on the lower part of the stem comes in contact with the tripper or catch 66 which has previously been holding down the stem 53 in the air and vacuum valve located underneath the large pressure cylinder. At this point there is a pressure of 25 inches above the center washer on the stem of the air and vacuum valve, and there is atmospheric pressure on the lower side of this center washer. Without the operation of

this holding down catch or tripper, this valve, with the gradual reduction of pressure due to exhaustion, would have traveled slowly upwardly, but as it is held down by the catch it cannot be moved until the catch has been released. The rising of the stem or piston in the tripper release mechanism releases this catch which has been holding down the air and vacuum valve and as there is 25 inches of pressure above the washer and atmospheric pressure underneath the washer, the stem flies up with considerable force and very quickly, thus admitting atmospheric air to the lower part only, of the large pressure cylinder. The washer 56 acts upon this upward motion to seal the opening through which the air is drawn through pipe 52 by the pump from the lower part of the large pressure cylinder. With the closing of this suction pipe and the admission of air underneath the large pressure piston 70, the piston which at this point has a pressure of 25 inches on its upper side is forced upwardly operating the levers which are connected to the pressure plate and forcing the caps onto the glass, until the point is reached where the pressure is all maintained by the glass itself. At this point, in other words, when the caps have been pushed tightly on the glass, the large spring 98 on the connecting rod at the back of the machine is set to open, so that air may be admitted through the portion 91 of the reversing valve located at the upper end of the large spring, to the front portion only of the reversing valve cylinder 90. By this action considerable air is admitted to the front portion of the reversing valve cylinder 90 and at the front of the piston 93, this being at the left hand side of said piston, looking at Fig. 17, through the large opening of pipe 92 and while the pump is still in operation on both sides of the piston in the reversing valve. The outlet to the pump on the front of the reversing valve consists of a very small hole 94, while the outlet 95 to the pump on the back of the reversing valve is considerably larger. The action of this is to admit more air to the front of the valve than the pump can take out quickly through this small hole, thus creating a pressure on the piston 93 in the reversing valve, forcing it backward and with it carrying the slotted member 95* which comes in contact with the point on the starting handle rod 96 and this action throws the starting handle backward and through the operation of the spring 146 on the stem of the starting valve, the starting valve is reversed and air thereby admitted to all the points which have previously contained a vacuum, that is the upper and lower part of the door cylinder and the upper part of the large pressure cylinder and the box itself, including the valves connected therewith. At this point the chamber 320 in the lower part of the duplex valve contains a vacuum and air admitted to the top of the piston on the lower end of the stem tends to hold the stem in the duplex valve 31 in its open position, allowing the air to get through into the pipes 37 connected to the box and the upper part of the pressure cylinder. At this point, also, a vacuum is created in the chamber 64 situated in the lower part of the air and vacuum valve. As there is also air on top of the head 55, the stem in the air and vacuum valve is drawn down to a position where the tripper catch comes into operation and holds it in that position. The action of this stem 53 then opens to the pump the pipe 52 through which the air is taken out of the bottom of the large pressure cylinder and as there is atmospheric pressure on top of this cylinder at this time, the large piston is forced downwardly, throwing up the outer end of the levers connected to the lower part of the stem and raising the plate. At this point the machine has returned to its original position, that is, the door has opened, pressure has been released from the plate, air has been admitted to the box and the preliminary motion which positioned the caps has been reversed and the plate has been raised to its highest position. At this point there is a vacuum in the center of the door cylinder, on both sides of the piston in the reversing valve, in the lower part of the starting valve, in the lower part of the duplex valve, in the lower part of the large presssure cylinder and in the lower part of the air and vacuum valve. The tray of containers may then be withdrawn and the machine is ready for the next operation.

The operation of the vacuum regulator valve is that when the pump has created the desired degree of pressure in the box 2, the pressure on the top washer 115[a] in the vacuum regulator valve being greater than the pull of the spring 123 on the lever 122 of the vacuum regulator valve, forces the lower washer 115[b] into the bore 114, thus shutting off the box from the pump.

The functions of the duplex valve are mainly to insure a tight-closing of the door and the preliminary motion of the plate and through the tightening or loosening of the spring in this valve can be made to operate at any desired point, that is the door can be closed with any degree of pressure desired so as to insure a tight-closing of the door so as to avoid reducing the efficiency of the machine through leakage during the closing operation. The unique feature of the duplex valve is the arrangement of the head with the cup washer on the lower part of the stem which holds the valve open so as to readmit air to the upper part of the pressure cylinder and to the box.

A similar arrangement may be found in

the air and vacuum valve located underneath the large pressure cylinder which by a differential in pressure operates very quickly and draws the stem down so as to open the channel for the removal of the air from the lower part of the large pressure cylinder. In the air and vacuum valve there is also a novel arrangement whereby I am enabled to carry a cup washer over an opening without destroying the washer in any way.

The operation of the duplex valve is that in the open position of the machine with the pump running there is a vacuum in the lower chamber 320 in this valve with atmospheric pressure on the top of the head 33 fitted with cup washer 34 in this chamber, there being always atmospheric pressure for the upper side of this head through holes 35 in the side of the valve casing. This tends to hold the spring 311 on the upper end of the stem 36, in a compressed position and holds the flat leather valve 31 away from the seat 32, allowing the air free access past this valve. When the handle is pulled and the starting valve reversed, the vacuum in the lower chamber 320 of the duplex valve is destroyed, leaving atmospheric pressure on both sides of the head 33 in this lower chamber. With the removal of the downward pull, the spring on the upper end of the stem pulls the stem 36 upward until the flat leather valve 31 comes in contact with the seat 32, thereby shutting off temporarily the pipe lines 37, etc. running to the box and the large pressure cylinder and the parts connected thereto. This flat seat remains in contact until a sufficient vacuum has been created in the door cylinder and the duplex valve to satisfactorily close the door, at which point the atmospheric pressure coming through the piping 37 running from the duplex valve to the large pressure cylinder and the box is sufficient to force the flat seat downward, allowing the escape of the air to the pump. This valve is maintained in its open position from that point by the atmospheric pressure on the top of the head 38 with cup washer 39 on the upper end of the stem 36 in the duplex valve casing and the vacuum underneath that cup washer. The stem remains in that position until the machine has operated and the starting valve is reversed, but at this point the cup washer 34 on the lower end of this stem becomes operative as the chamber 320 in the bottom part is vacuumized at that time and the stem is thus held down so as to allow the air free access to the box and the upper part of the large pressure cylinder.

On starting to use the machine, power from the pump opens the door and elevates the plate, this being caused by creating the reduction of pressure due to exhaustion at the lower side of the piston 70 in the pressure cylinder 5 and admitting atmospheric air to the other side of the same piston and if nothing else is done the door will remain open and the plate will remain up. When I want the machine to go into operation, which would be after I place the tray of glasses with caps loosely thereon into the box, I break the vacuum beneath piston 70 and exhaust the air from above said piston, thus causing the piston to ascend, whereby the door is caused to close, the plate to descend as far as I want it to descend, according to the adjustment, the air is exhausted from the box and finally the plate is lowered to press the caps on the jars, after which the door first opens, then the plate elevates and the tray of sealed glasses are free for removal.

I want to make it clear that during the vacuumizing operation, after I get the proper degree of vacuum in the box required for the goods handled, the continued action of the pump for applying power to the operative mechanism of the machine does not act on the box, but is cut off therefrom so that the requisite vacuum which I did get into the box may be maintained as long as I want it.

It is necessary to have a predetermined amount of vacuum in the sealing box in accordance with the goods treated, some requiring 8 inches and some requiring anywhere up to 25 or more inches. When the proper degree for the box is obtained, the box must be shut off, because we might require a greater degree of power from the pump for operating the mechanical devices of the machine, such as for opening the door, applying pressure to the plate and other parts. Therefore the construction enables one to seal off the box when the requisite vacuum is therein and then the pump continues in operation so as to produce the proper power for operating the mechanical part of the machine as an independent matter.

The machine of my invention is also useful in sealing jars and the like without creating a vacuum in the box or closet, and hence while I principally claim a vacuum sealing machine, I desire it understood that my invention also includes the machine for sealing jars in the absence of a vacuum, the vacuum not being required in certain conditions of sealing jars containing, for illustration, vegetables that have been previously processed and have special caps.

What I claim as my invention and desire to secure by Letters Patent, is:

1. In a machine for applying caps to containers, a sealing chamber, a door for said chamber, a sealing head movable in said chamber, a source of vacuum, means including a cylinder and piston for actuating the sealing head in its cap pressing movements, means including a cylinder and piston for

actuating the sealing head in cap-retaining movements prior to the pressing home of the caps, means including a cylinder and piston for actuating the door of the sealing chamber, a system of passages providing communication between the sides of the several pistons and the source of vacuum and the atmosphere, a reversible starting valve connected to the source of vacuum and controlling the distribution of vacuum in said system, a duplex valve interposed in said system between the starting valve on the one hand and the sealing head cylinder and the sealing chamber on the other hand said duplex valve controlling the air and vacuum supply to the sealing chamber and one side of the piston of the sealing head cylinder, an automatic loaded air and vacuum valve controlling the admission of atmospheric pressure and vacuum to the other side of the piston of the sealing head cylinder, an adjustably loaded tripper mechanism, a trip lever actuated by the tripper mechanism when a predetermined vacuum prevails in said chamber, means co-operating with the trip lever for normally locking the air and vacuum valve in closed position, said locking being interrupted upon functioning of the trip lever, a vacuum regulating valve disposed between the source of vacuum and the sealing chamber and equipped with regulating means whereby said valve will shut off the chamber from said source when a predetermined vacuum is established in the chamber but without disturbing the communication between said source and the operating cylinders, a reversing valve for reversing the starting valve at the end of a capping operation to thereby restore the machine to condition for capping fresh containers, a manually operable device for operating the reversible starting valve, and driving connections between said manually operable device and the reversing valve, the several valves herein mentioned, except the reversing valve, having plungers and cylinders for operating the valves by the action of atmospheric pressure and vacuum on the ends of said plungers whereby all the functions of the machine are produced by vacuum; substantially as described.

2. In a machine for applying caps to containers, a source of vacuum, a stationary sealing chamber, a door for said chamber, a sealing head movable in said chamber, means including a cylinder and piston for actuating the sealing head, means including a cylinder and piston for actuating the door of the sealing chamber, a conduit connecting one side of the sealing head actuating piston with the sealing chamber, a valve system including a reversible starting valve controlling communication between said cylinders and the source of vacuum and the atmosphere, a duplex valve interposed between the reversible starting valve and said conduit, said duplex valve controlling communication between said starting valve and conduit, an air and vacuum valve controlling the admission of atmospheric pressure and vacuum to the other side of the sealing head piston, a reversing valve, and means actuated by the reversing valve for reversing the starting valve at the end of a capping operation to thereby restore the machine to condition for capping fresh containers, the several valves herein mentioned, except the reversing valve, having plungers and cylinders for operating the valves by the action of atmospheric pressure and vacuum on the ends of said plungers whereby all the functions are produced by vacuum; substantially as described.

3. In a machine for applying caps to containers, a source of vacuum, a stationary sealing chamber, a door for said chamber, a sealing head movable in said chamber, means including a cylinder and piston for actuating the sealing head, means including a cylinder and piston for actuating the door of the sealing chamber, a conduit connecting one side of the sealing head actuating piston with the sealing chamber, a valve system including a reversible starting valve controlling communication between said cylinders and the source of vacuum and the atmosphere, a duplex valve interposed between the reversible starting valve and said conduit said duplex valve controlling communication between said starting valve and conduit, an air and vacuum valve controlling the admission of atmospheric pressure and vacuum to the other side of the sealing head piston, and a vacuum regulating valve disposed between the source of vacuum and the sealing chamber and equipped with regulating means whereby said valve will shut off the chamber from said source when a predetermined vacuum is established in the chamber but without disturbing communication between said source and the cylinders, the several valves herein mentioned having plungers and cylinders for operating the valves by the action of atmospheric pressure and vacuum on the ends of said plungers whereby all the functions are produced by vacuum; substantially as described.

4. In a machine for applying caps to containers, a source of vacuum, a stationary sealing chamber, a door for said chamber, a sealing head movable in said chamber, means including a cylinder and piston for actuating the sealing head, means including a cylinder and piston for actuating the door of the sealing chamber, a conduit connecting one side of the sealing head actuating piston with the sealing chamber, a valve system including a reversible starting valve controlling communication between said cylinders, and the source of vacuum and the

atmosphere, a duplex valve interposed between the reversible starting valve and said conduit said duplex valve controlling communication between said starting valve and conduit, an air and vacuum valve controlling the admission of atmospheric pressure and vacuum to the other side of the sealing head piston, an adjustably loaded tripper mechanism, a trip lever actuated by the tripper mechanism when a predetermined vacuum prevails in said chamber, and means cooperating with the trip lever for permitting automatic operation of the air and vacuum valve upon functioning of the trip mechanism, the several valves herein mentioned having plungers and cylinders for operating the valves by the action of atmospheric pressure and vacuum on the ends of said plungers whereby all the functions are produced by vacuum; substantially as described.

5. In a machine for applying caps to containers, a source of vacuum, a stationary sealing chamber, a door for said chamber, a sealing head movable in said chamber, means including a cylinder and piston for actuating the sealing head, means including a cylinder and piston for actuating the door of the sealing chamber, a conduit connecting one side of the sealing head actuating piston with the sealing chamber, a valve system including a reversible starting valve controlling communication between said cylinders and the source of vacuum and the atmosphere, a duplex valve interposed between the reversible starting valve and said conduit said duplex valve controlling communication between said starting valve and conduit, and an air and vacuum valve controlling the admission of atmospheric pressure and vacuum to the other side of the sealing head piston, the several valves herein mentioned having plungers and cylinders for operating the valves by the action of atmospheric pressure and vacuum on the ends of said plungers whereby all the functions are produced by vacuum; substantially as described.

6. In a machine for applying caps to containers, a sealing chamber, a door for said chamber, a sealing head movable in said chamber, a source of vacuum, means including a cylinder and piston for actuating the sealing head in its cap pressing movements, means including a cylinder and piston for actuating the sealing head in cap retaining movements prior to the pressing home of the caps, means including a cylinder and piston for actuating the door of the sealing chamber, and a system of valves and connections for controlling communication between the ends of the several pistons and the source of vacuum and the atmosphere, said system including a reversible starting valve directly connected to the source of vacuum; substantially as described.

7. In a machine for applying caps to containers, a sealing chamber, a door for said chamber, a sealing head movable in said chamber, a source of vacuum, means including a cylinder and piston for actuating the sealing head in its cap pressing movements, means including a cylinder and piston for actuating the sealing head in cap retaining movements prior to the pressing home of the caps, means including a cylinder and piston for actuating the door of the sealing chamber, and a system of valves and connections controlling communication between said chamber and cylinders, the source of vacuum and the atmosphere whereby all said means are operated solely by vacuum from the source; substantially as described.

8. In a machine for applying caps to containers, a vacuum pump, a closable sealing chamber, a sealing head movable in said chamber, means for moving the sealing head, a connection between the vacuum pump and the means for moving the sealing head, means whereby vacuum is maintained in said sealing chamber by said pump said means including a connection between the pump and the sealing chamber, and a valve in said last mentioned connection adapted to close the same while leaving open the connection between the pump and the means for moving the sealing head; substantially as described.

9. In a machine for applying caps to containers, a source of vacuum, a closable sealing chamber, a sealing head in said chamber, vacuum driven means for operating the sealing head, vacuum driven means for effecting proper opening and closing of the sealing chamber, connections between the source and both said means whereby these latter are actuated solely by the source of vacuum, means whereby vacuum is maintained in said sealing chamber by said source, and means for regulating the vacuum in said chamber from any desired maximum to zero; substantially as described.

10. In a machine for applying caps to containers, a source of vacuum, a stationary sealing chamber, a sealing head therein, means for connecting said chamber to vacuum and to atmosphere in alternation, vacuum driven means for raising and lowering the sealing head, and valved connections between the source and both said means whereby the latter are driven by pressure differences between the source of vacuum and the atmosphere as the sole driving power; substantially as described.

11. In a machine for applying caps to containers, a source of vacuum, a stationary sealing chamber, a door for said chamber, a sealing head movable in said chamber, means including a cylinder and piston for actuating the sealing head, means including a cylinder and piston for actuating the door of the sealing chamber, a conduit connecting

one end of the sealing head actuating piston with the sealing chamber, a valve system including a reversible starting valve controlling communication between said cylinders and the source of vacuum and the atmosphere, a duplex valve interposed between the reversible starting valve and said conduit said duplex valve controlling communication between said starting valve and conduit, an air and vacuum valve controlling the admission of atmospheric pressure and vacuum to the other end of the sealing head piston, a two part reversing valve, means actuated by one part of the reversing valve for reversing the starting valve, means for operating said valves to subject the opposing sides of the said pistons selectively to atmospheric pressure and vacuum, link and lever connections between the sealing head and the piston of the sealing head operating cylinder, said connections including a resilient link, carrying the second part of the said reversing valve for causing operation of the said first part of the reversing valve when sufficient yielding of said link takes place as a result of the sealing head completing the capping of the containers; substantially as described.

12. In a machine for applying caps to containers, a sealing chamber, a door for said chamber, a sealing head movable in said chamber, a source of vacuum, means including a cylinder and piston for actuating the sealing head in its cap pressing movements, means including a piston for actuating the sealing head in cap retaining movements prior to the pressing home of the caps, means including a piston for actuating the door of the sealing chamber, said two last mentioned pistons operating in cylinders combined to form a unit, and a system of valves and connections for controlling communication between the ends of the several pistons and the source of vacuum and the atmosphere said system including a reversible starting valve directly connected to the source of vacuum; substantially as described.

13. A machine as claimed in claim 7, comprising link and lever connections between the sealing head and the two pistons which actuate the sealing head, said connections comprising a lever which is coupled to both said pistons; substantially as described.

14. In a machine for applying caps to containers, a source of vacuum, a sealing chamber, a stationary support therein for the containers, a sealing head in said chamber, vacuum driven means for operating the sealing head, vacuum driven means for connecting the sealing chamber in alternation with the source of vacuum and the atmosphere, and valved connections between the source of vacuum and the two vacuum driven means; substantially as described.

Signed at New York city, in the county of New York and State of New York, this 19th day of June, A. D. 1922.

HARRY INGRAM.